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National Aeronautics and Space Administration  
Office of Biological and Physical Research  
Washington, DC 20546

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## **Research Announcement**

**Research Opportunities in  
Space Biological Sciences**

**Advanced Human Support  
Technology Program  
2003**

**NRA 03-OBPR-01  
March 13, 2003**

**NASA Research Announcement Soliciting Research Proposals for  
the Period Ending June 13, 2003**

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**Notices of Intent Due: April 14, 2003**  
**Proposals Due: June 13, 2003**

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# Research Opportunities in Space Biological Sciences, Advanced Human Support Technology Program, 2003

## NRA 03-OBPR-01

### Summary and Supplemental Information

NASA has a new Vision:

*To improve life here,  
To extend life to there,  
To find life beyond.*

The Office of Biological and Physical Research's (OBPR) contribution to the Agency is to realize this Vision written as a Mission Statement that motivates our research on the ISS and is the framework for the activities of OBPR:

*Humans will extend the exploration of space. To prepare for and hasten the journey, OBPR must answer these questions through its research:*

- How can we assure the survival of humans traveling far from Earth?
- What must we know about how space changes life forms, so that humankind will flourish?
- What new opportunities can our research bring to expand our understanding of the laws of nature and enrich lives on Earth?
- **What technology must we create to enable the next explorers to go beyond where we have been?**
- How can we educate and inspire the next generations to take the journey?

OBPR is developing a Research Plan that will provide a top-level description of the direction that the Enterprise will take to answer these questions and fulfill its mission. The OBPR Research Plan can be accessed at the following Web site:

**<http://spaceresearch.nasa.gov>**

The Advanced Human Support Technology (AHST) Program of the Bioastronautics Research (BR) Division of NASA's Biological and Physical Research (BPR) Enterprise focuses its research and technology development efforts to primarily address the following organizing question: What technology must we create to enable the next explorers to go beyond where we

have been? The AHST Program Elements of Advanced Environmental Monitoring and Control (AEMC), Advanced Life Support (ALS), and Space Human Factors Engineering (SHFE), through their respective efforts, address the following specific questions as stated in the OBPR research plan:

- How can we change spacecraft systems to lessen the required up-mass, volume, power and crew time?
- How can technology help human productivity and well being during extended isolation from Earth?
- How can we ensure that a crew is living in a safe and comfortable environment?
- What is the optimal way to support environmental health for crewmembers of space flights?

This NASA Research Announcement (NRA) solicits research and technology development proposals that support the opening of the space frontier by exploring, using, and enabling the development of space, and by expanding human experience in space. The research supported by the OBPR will increase knowledge of nature's processes using the space environment, aid in the exploration of the Solar System, support the achievement of routine space travel, and enrich life on Earth through the use of space technology. The BPR Enterprise also seeks to share new knowledge, technologies, and assets that promise to enhance the quality of life on Earth.

The AHST Program seeks to fund the development of advanced technologies for use on the International Space Station (ISS) beyond current baseline technologies, or on a long duration human exploration mission. Special emphasis is placed on those technologies that will have a dramatic impact on the reduction of required mass, power, volume, crew time, and on increased safety and reliability.

All participants in this NRA are strongly encouraged to promote general scientific literacy and public understanding of life sciences, the space environment, and the OBPR programs through formal and informal education opportunities. Where appropriate, supported investigators will be required to produce, in collaboration with NASA, a plan for communicating their work to the public (see Appendix B, Section VI).

Proposals for this NRA are due by 4:30 p.m. Eastern Time on June 13, 2003. Proposals shall not be submitted electronically, except for the Proposal Cover Page as specified in Appendix B of this NRA. Proposals mailed through the U.S. Postal Service by express, first class, registered, or certified mail should be sent to the following address:

NASA Peer Review Services  
SUBJECT: 03-OBPR-01, AHST Research Proposal  
500 E Street SW  
Suite 200  
Washington, DC 20024

Proposals that are hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between 8:00 a.m. and 4:30 p.m. Eastern Time. Proposals must be received by 4:30 p.m. Eastern Time on the proposal due date. The telephone number, (202) 479-9030, may be used when required for reference by delivery services. NASA Peer Review Services (NPRS) cannot receive deliveries on Saturdays, Sundays, or federal holidays. NPRS will send notification to the investigator confirming proposal receipt within five (5) business days of the proposal receipt date; however, there will not be a response from the Office of Biological and Physical Research.

The following items apply only to this Announcement:

<b>Solicitation Announcement Identifier:</b>	<b>NRA 03-OBPR-01</b>
<b>Number of Copies Required:</b>	<b>Original (one-sided) + 20 copies (double-sided)</b>
<b>Notices of Intent Due:</b>	<b>April 14, 2003</b>
<b>Proposals Due:</b>	<b>June 13, 2003</b>
<b>Estimated Selection Announcement:</b>	<b>November 2003</b>
<b>Selecting Official:</b>	<b>Director, Bioastronautics Research Division, Office of Biological and Physical Research</b>

All prospective proposers to this NRA are advised that the highest priority in all of NASA's programs is given to safety and mission assurance, occupational health, environmental protection, information technology, export control, and security. NASA's safety priorities are to protect (i) the public, (ii) astronauts and pilots, (iii) the NASA workforce (including employees working under NASA instruments), and (iv) high-value equipment and property. All proposals submitted in response to this solicitation are expected to comply with this policy.

This NRA is organized such that

- Appendix A provides a detailed description of the research areas solicited by this Announcement.
- Appendix B contains specific instructions for this NRA and relevant application forms, and the selection process.
- Appendix C contains copies of the certifications required with any signed application.
- Appendix D provides reference instructions for responding to NASA Research Announcements.

Proposals submitted in response to this Announcement must address the research emphases defined in this Announcement. *For Fiscal Year 2004, each of the program elements described in this NRA has a unique proposal solicitation with particular needs for specific kinds of proposals in specific areas of emphasis. Therefore, it is critical that potential applicants carefully read the AHST Program and Program Element descriptions in Appendix A of this Announcement.* Those proposals that do not address research within the scope of the AHST Program will be returned to

the investigators. Other Announcements calling for focused research or utilization of unique resources may be issued throughout the year. Unsolicited proposals received at other times during the year will be held until the next annual review period if the proposed research is relevant to the programs described in this Announcement. However, NASA reserves the right to act in the best interest of the Federal Government in the matter of proposal acceptance and evaluation.

Proposals will be funded in one-year increments for activities lasting up to three years for conventional ground-based research studies, rapid technology development (RTD) teams, and space flight experiments. The funding duration will depend on proposal requirements, review panel recommendations, and continuing progress of the activity. Selected Pilot Studies will receive Phase I funding for a period of 18 months.

All proposals will be evaluated for overall scientific and technical merit by independent peer review panels, including an assessment of the innovativeness of the proposed work. Where appropriate, NASA will also conduct separately an assessment of cost, relevance to AHST programmatic needs and goals, flight feasibility, and the feasibility of implementation of the completed work by NASA (see Appendix B, Section II, for more information on the proposal evaluation and awards selection process).

It is anticipated that a typical award for ground-based research or space flight experimentation will average approximately \$175K per year in total annual costs. Proposals for awards substantially greater than these amounts must provide adequate justification. The average award for Rapid Technology Development teams likely will be in the range of \$500K per year. Support for Pilot Studies will be approximately \$80K per study for Phase I funding.

NASA reserves the right to return, without review, proposals that exceed the described award amounts. NASA does not provide separate funding for direct and indirect costs; thus, the amount of the award requested is the total of all costs submitted in the proposed budget. It is anticipated that selections will be announced by November 2003 and that subsequent grants, contracts, or cooperative agreements will be awarded shortly thereafter. The Government's obligation to make award(s) is contingent upon the availability of appropriated funds from which payment can be made and receipt of proposals that NASA determines are acceptable for award under this NRA.

Participation in this Announcement is open to all categories of organizations, including industry, educational institutions, other nonprofit organizations, NASA laboratories, and other government agencies. Guidelines for International Participation are detailed in Appendix B, Section IV, and Appendix D, Section (I), of this Announcement.

A notice of intent to propose is requested by **April 14, 2003** (see Instructions, Appendix B, of this Announcement). Notices of intent should be submitted via the World Wide Web (WWW) at

**<http://proposals.hq.nasa.gov/proposal.cfm>**

If you do not have access to the WWW, you may submit a notice of intent via e-mail to

**noi@hq.nasa.gov**

The subject heading of the e-mail message should read “Notice of Intent: 03-OBPR-01 AHST Program.” If you do not have access to e-mail, you may submit a notice of intent by U.S. Postal Service or commercial delivery to the address listed for proposal submission.

In order to be accepted as a complete submission, proposals must include all information requested in Appendix B. Additional technical information is available from

Charles J. Barnes, Ph.D.  
NASA Headquarters, Code UB  
Washington, DC 20546-0001  
Telephone: (202) 358-2365  
Fax: (202) 358-4168  
E-mail: cbarnes@hq.nasa.gov

The specific contracting point of contact will be specified in each selection notification letter.

This Announcement is restricted to the program named above and described in detail in Appendix A. Potential investigators should read with care the program descriptions that are of interest and focus their proposals on the specific research emphases defined in this Announcement.

Your interest and cooperation in participating in this effort is appreciated.

Original signed by

Mary E. Kicza  
Associate Administrator  
Office of Biological and Physical Research

**Scientific/Technical Description**  
**Research in Space Biological Sciences,**  
**Advanced Human Support Technology Program, 2003**

**I. Introduction**

The National Aeronautics and Space Administration's (NASA) Bioastronautics Research (BR) Division seeks proposals for the Advanced Human Support Technology (AHST) Program in support of the Biological and Physical Research (BPR) Enterprise. This Announcement solicits scientific and technical proposals to be funded during fiscal year 2004, either for new research or for the continuation of research beyond the term specified in a previously funded grant.

This Appendix defines the research program and elements encompassed by this Announcement, describes the specific areas of research and technology development that proposals should address, and describes the specific emphases that are acceptable for submission in response to this Announcement. It is important that the prospective investigator read the relevant section(s) carefully, as some of the programmatic emphases are different from those appearing in previous Announcements. In addition, this NRA includes guidelines for preparing and submitting proposals and defines the administrative policies governing the program and investigators.

This announcement solicits proposals for the following Program Elements within the AHST Program:

- Advanced Environmental Monitoring and Control (AEMC)
- Advanced Life Support (ALS)
- Space Human Factors Engineering (SHFE)

In addition to requirements specified in other sections of this NRA, investigators responding to this Announcement for the AHST Program will be expected to

- Include a one-page justification on how the proposed research satisfies the unique requirements of the AHST program in general and the research element in particular. The justification should include reference to relevant risks identified in the Critical Path Roadmap that the proposed research might mitigate. The Critical Path Roadmap is available online at

**<http://criticalpath.jsc.nasa.gov/>**  
(Follow links to appropriate discipline area.)

In fulfilling this requirement, investigators are encouraged to refer also to current Project Plans and other relevant background documents. These documents are available at

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

(See References, Appendix B, Section VII.)

- Establish contact with appropriate NASA field center personnel to determine how the proposed research or technology development activity might fit into NASA's AHST Program. Contact information for appropriate NASA personnel is provided throughout Section III of this Appendix.
- Discuss (and quantify, if possible) in their proposal the potential benefit of their work to NASA in terms of minimization of mass, power and crew time utilized, increased system reliability, safety, or other factors for present or future missions. Investigators are encouraged to refer to the system analysis assumptions as reflected in the ALS baseline values and assumption document (BVAD) and the discussion of equivalent system mass (ESM) in the ALS Metric. These documents may be found at the following Web site:

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

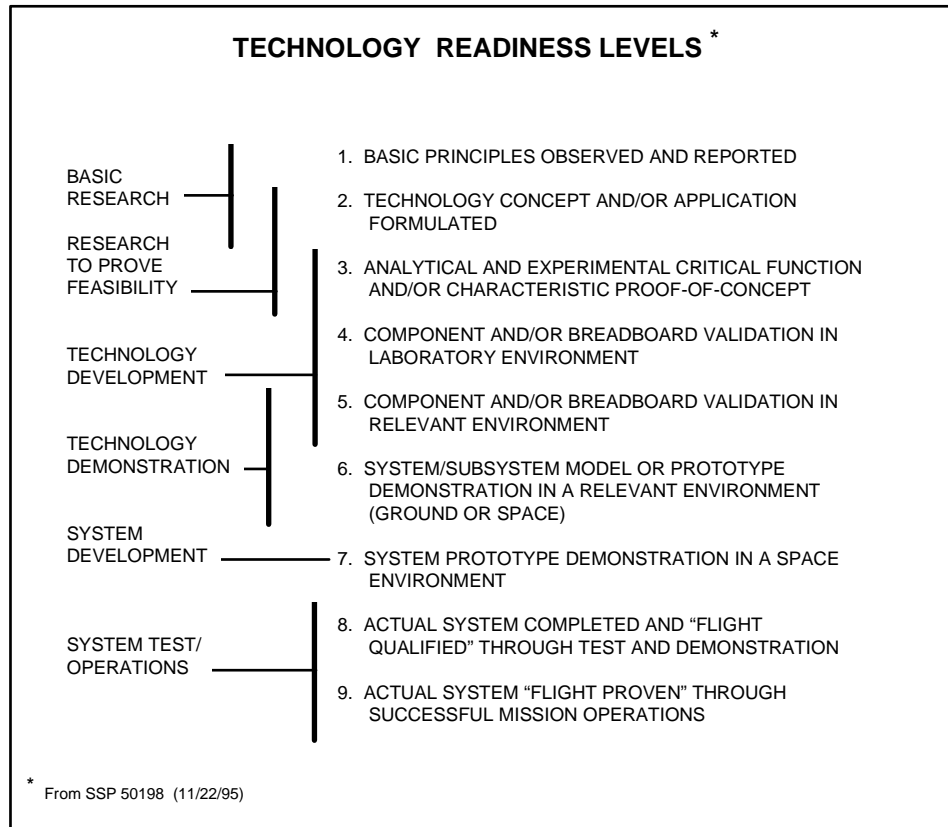
- Assure compliance with federal regulations regarding human subjects and/or animal care as part of the proposal submission process (see the "Special Matters" section in Appendix B). NASA has a strong commitment to the ethical treatment of human and animal research subjects. Applicants should note that review of proposals involving human or animal research subjects will not be undertaken if the required information is not supplied.

## **II. Types of Proposals Sought**

Each of the AHST Program Elements described in this Announcement has unique needs for specific kinds of proposals in specific areas of emphasis. *Proposals for Research and Technology Development in areas outside the specific areas of emphasis listed in this Announcement will likely receive lower priority for funding.*

A proposal may be multidisciplinary or interdisciplinary, involving combinations of these research and technology development project areas. For such proposals, the teaming arrangements should be clearly stated. Flight proposals should include a well-defined development plan that can be accomplished within **three** (or fewer) years.

In addition to the overview information listed below, prospective investigators should also carefully read the individual Program Element descriptions in Section III of this Appendix. Investigators also should be aware of the concept of Technology Readiness Levels (TRLs) as it applies to their work (see Figure 1 below).



**Figure 1. NASA Technology Readiness Levels**

Research and technology development funded through this NRA must be at TRLs appropriate for the corresponding proposal type as described below (Subsections A – D):

**A. Ground-Based Pilot Studies (open to all Program Element areas for FY 2004)**

High-innovation, high-risk technology development Pilot Study proposals for low TRL work (TRL 1–2, see Figure 1) are solicited. Pilot Studies are expected to propose highly innovative approaches or to explore new research paradigms or concepts that will strongly affect human support technologies, even if they are highly speculative or contain a substantial risk of failure. The goal of this type of proposal solicitation is to prepare for rapid insertion of highly innovative new research ideas into demonstration technologies [e.g., for the International Space Station (ISS) or for an integrated ground test facility]. Awards in this category are for no more than 18 months, averaging a total cost of \$80,000, and require attendance at two NASA-lead Principal Investigator (PI) team meetings during the course of funding. If the pilot project is successful, PIs given a Pilot Study award will be expected to form and participate in teams that develop follow-on proposals for longer-term work leading to direct insertion into a NASA AHST application.

For the Pilot Study proposal category, the initial 18 months of Phase I funding is envisioned to be the first of two possible phases. Phase I funding does not guarantee Phase II funding; however, Phase I funding is a prerequisite. Phase II will emphasize the integration of Phase I approaches into actual technology development, with a strong emphasis on teaming. Teams will be developed among PIs and with NASA investigators. Team development for Phase II will be facilitated through the NASA Headquarters lead and the NASA Technical Monitor for Phase I projects. Teams developed for Phase II projects will be expected to propose within three months of completion of Phase I. Phase II proposals will be separately evaluated, but will use criteria as described in Section II of Appendix B, with an emphasis placed on probability of successful development of a prototype instrument that can be demonstrated in a relevant environment (i.e., TRL 5–6, see Figure 1) at the end of the three-year Phase II funding period.

To facilitate the overall goal of rapid insertion, the review of Pilot Studies will emphasize the Innovation and Significance review criteria. Review criteria are detailed in Appendix B, Section II.

*Currently funded AHST PIs may contact relevant NASA personnel if interested in participating in future teaming and proposal development.*

## **B. Ground-Based Research and Technology Development (open to all Program Element areas for FY 2004)**

These are proposals to carry out a research study or technology development in a ground-based laboratory. Typically these will be for low TRL work (TRL 1–3, see Figure 1) with a clearly defined set of technical objectives relevant to NASA’s BPR Enterprise goals and addressing one or more of the critical questions in the OBPR Research Plan. Awards in this category will be for no more than three years and will average \$175,000.

## **C. Rapid Technology Development (RTD) Teams (open to all Program Element areas for FY 2004)**

Critical to NASA’s technology maturation process model (Figure 1 in this Appendix) is the development of technologies through TRL 6, where demonstration, validation, and integration studies are performed in an environment relevant to the application. The ultimate objective of developing RTD Teams will be to advance a given technology to TRL 6 such that it will be ready by the end of the funding period to be further developed by NASA into hardware, software, or procedures for testing in flight conditions. These studies should be conducted at or in association with appropriate NASA Field Centers, utilizing unique ground-based test facilities that may include test stands for subsystem integration, chambers for controlled environment, vacuum and space environment simulation, or large-scale human-rated mission simulation test facilities. RTD Teams will use teaming arrangements between investigators and technology development specialists to rapidly advance the targeted technology to approximately TRL 6 and may average awards of as much as \$500,000 per year for three years. Potential RTD Teams should strongly consider inclusion of an appropriate NASA partner in their proposals, as such partnerships have

historically increased the feasibility and likelihood of the eventual manifesting of the targeted technology. Proposers of RTD Teams should contact the appropriate NASA personnel, identified throughout Section III of this Appendix, in order to identify potential NASA partners. The other partners could include personnel from industry, academia or other Government and non-Government organizations. Teams proposing RTD projects should demonstrate knowledge of the state of the art for the technologies that they propose to develop. Additional factors, such as current practices on the Shuttle or ISS for relevant operations, must be taken into account when proposing solutions. These RTD Teams may work with NASA through cooperative agreements and will be renewable annually, based on an assessment of progress and the continued availability of funding.

#### D. Space Flight Experiments (open to all Program Element areas for FY 2004)

Proposals are solicited for space flight experiments that are anticipated to be flown in the time period between **2006 and 2008**. All flight experiments must address one or more of the AHST Program Element areas of emphases described in this Research Announcement. Flight investigations must represent mature studies strongly anchored in previous ground-based research and/or previous flight research and must be thoroughly justified.

The research will be accomplished during utilization flights when the Space Shuttle visits the ISS, and during the time periods between the utilization flights when the permanent onboard crew will act as experiment operators and, if necessary, as subjects. Other vehicles (such as Progress or Soyuz) also may be utilized to deliver experiments to ISS. The duration of microgravity exposure can, in theory, be indefinite, with brief disturbances expected to occur at approximately 30 day intervals caused by U.S. and Russian transportation vehicle docking activities.

The primary opportunities to transport scientific equipment, supplies, and samples will be on the ISS utilization Shuttle flights. However, modest capabilities for research-related deliveries and sample returns will be available on ISS assembly Shuttle flights that typically will occur every 40 to 90 days. Refrigerated stowage for transport of samples on the Shuttle will be very limited, and during certain time frames, refrigerated stowage may not be available on the Space Station. Power outages may also be experienced during the assembly of ISS. Experiments with few or simple user/operator-required in-flight activities have the greatest potential for selection during this time frame due to their simpler logistic requirements.

The experiment opportunities are highly constrained in a number of ways. Proposals requiring resources beyond the capabilities defined below should not be submitted in response to this Announcement.

Potential applicants should recognize that, given the limited availability of flight opportunities, the flight experiments area is likely to be one of the most competitive arenas within the Office of Biological and Physical Research. Above all, flight experiments must have a justification that requires microgravity or other unique aspect of the space environment not reproducible in a ground analog. Furthermore, only flight experiment proposals representing mature studies

strongly anchored in previous or current ground-based or flight research or technical evaluation will be selected. Ground-based research may, and often must, represent one component of a flight experiment proposal. That research should be limited to activities that are essential for the final development of an experiment for flight, such as definition of flight protocols and ground control activities of the flight experiment. In this case, only one (flight) proposal need be submitted.

It is expected that flight experiments will propose the development of new hardware and may make use of existing or planned hardware for ISS and Space Shuttle. Proposals for new hardware development should be compatible with implementation in EXPRESS racks on ISS.

Flight experiments should be proposed in anticipation that the actual flight of the experiment will occur between **2006 and 2008**. Experiments that cannot be implemented within this time period should not be submitted. Proposals requesting only one flight to meet their proposed research goals have a higher probability of being accomplished, but multiple flight opportunities may be granted if justified.

Finally, potential applicants should be aware that selection for flight is a multi-step process.

1. Following the initial evaluation of flight proposals, a small group of investigators will receive a letter informing them that their experiment has been selected for **definition**.
2. During the **definition phase**, NASA will interact with the applicant to determine whether the proposed experiment can actually be carried out on a space mission and to refine the cost estimates for the flight experiment.
3. At the end of the definition phase, NASA will select a smaller group of investigations to be developed for flight. Normally, full investigator research funding does not begin until the initiation of the **development phase**.

*Note: All experiments selected for flight are subject to possible de-selection in accordance with the Advanced Human Support Technology Flight Experiment Management Policy available online at*

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

### **III. Research Emphases**

#### **A. Advanced Environmental Monitoring and Control (AEMC)**

##### **Program Element Description**

The AEMC Program Element of the AHST Program develops advanced technologies to monitor the physical, chemical, and microbial environments of both the human compartments and life

support systems of current and future spacecraft and extravehicular activity (EVA) systems. The AEMC Program Element provides technology for reducing crew and equipment risk that is comparable to or better than currently available technology. Advancements in microelectronics and biotechnology are expected to provide the backbone for these technologies in future missions. The AEMC Program Element also develops advanced control systems to maintain internal environments in the states necessary for crew health and safety. The control system may also take advantage of microtechnologies that are capable of effector functions, for example, capture and removal of bioparticles, and methods for efficiently collecting sensor information. Information regarding individual projects funded by the AEMC Program Element is available through the OBPR Task Book at

**[http://research.hq.nasa.gov/taskbook/tb2002/search/retrieve\\_taskbook.cfm](http://research.hq.nasa.gov/taskbook/tb2002/search/retrieve_taskbook.cfm)**

(Select the “Advanced Environmental Monitoring and Control” Program Element on the Task Book search screen.)

### **Proposals Sought for FY 2004**

Proposals are sought in specific areas of sensor technology and control concepts and implementation that will have a dramatic impact on the reduction of required mass, power, volume, crew time, and increased safety and reliability. The impact may be direct, for example, through drastic reduction of the size of a monitoring technology; or the impact may be indirect, for example, through improved monitoring that leads to the elimination of the need for a processing step.

The response time of the monitoring or control technology should be appropriate for the intended application. For example, an event such as a fire must be detected and responded to swiftly; whereas a gradual buildup of trace chemicals over several months could be monitored on an infrequent basis. The environments of interest include air, water, surfaces, food supplies, and all life support processing technologies. EVA sensors of interest include small low power/mass technologies for monitoring spacesuit internal/external environment and biomedical parameters.

Proposals may cover the development of new technologies; the refinement and micro-miniaturization of currently available sensors; new control paradigms that clearly demonstrate reduced risk or improved efficiencies; or very high-risk, very high-payoff new concepts that may lead to advanced sensors or control concepts with vastly improved capabilities. Technologies that may meet these needs with multi-use capability are desirable. Sensors are sought that can monitor multiple media (e.g., air and water) and have the potential to reduce mass and volume in terms of redundant units (i.e., one unit may serve as a backup for two systems). Environmental monitoring technologies may be useful for noninvasive physiological measurements as well as for habitat use.

*Finally, because of NASA’s strong commitment to public safety, as well as our mission to create a safe environment for astronauts, proposals for sensor technologies and control systems that also focus on advanced technologies for terrestrial applications such as counter-terrorism are*

*highly encouraged.*

**For FY 2004, the AEMC Program Element will emphasize**

**Pilot Studies Only**

Monitoring the Microbial Environment

Maintaining a safe microbial environment is important for astronaut health as well as for public safety. It is important to ensure a safe, appropriate microbial environment in the air, water, food, and on surfaces, as well as in the different life support subsystems. Proposals are sought that will take advantage of the latest in biotechnology research to provide easy-to-use, rapid, sensitive, accurate assessment of the microbial environment while employing little or no expendables, and requiring minimal sample preparation.

Chemical Water Quality Monitoring

Future space missions will routinely recycle water. It is therefore important to monitor for the gradual buildup of, or accidental contamination with, harmful chemicals, both organic and inorganic. As the toxicity varies from species to species, identification and quantification of individual species is desirable.

Sample Acquisition and Handling

Water monitoring for chemicals, as well as microbial monitoring in general, must deal carefully with efficient, uncontaminated acquisition of the sample and proper handling of that sample during analysis. This area may be proposed to directly, or may be incorporated as part of a proposal in microbial or water quality monitoring.

**Pilot Studies and Conventional Proposals**

Advanced Control Systems Approaches

A future system to support life in space for long durations will be both highly complex and critical to safety. It will therefore be essential to have an efficient communication network and an intelligent control system capable of autonomous assessment of monitoring and control system status and having the ability to respond, as necessary, to changes in system status. This NRA emphasizes

- Advanced approaches for efficient, reliable, optimal control, which can be incorporated in a straightforward manner. Advanced tools for modeling system behavior and incorporating these models into a control strategy.
- Advanced approaches for integrating the control strategies among the interacting subsystems, which are expected to include air revitalization, water reclamation, biomass production, food processing, and waste management.
- Tools for global assessment of control design strategies and monitoring applications.

- Approaches including strategies for recovery from perturbations. Perturbing upsets may be physical, chemical, or biological (including human error) in nature that may eventually lead to the subsystem/system failure.

### **Rapid Technology Development Teams**

Teams are sought that will be composed of members from both the research and development community and the mission operations community. The emphasis will be on chemical and microbial monitoring in the astronaut habitat. Approaches are sought that will provide dramatic improvement in the near term. Chemical hazards may arise from the slow accumulation of toxic chemicals, starting from harmless trace levels but proceeding gradually to increasingly dangerous levels. Chemical detection may also indicate hazardous events such as the start of a fire or a chemical leak. Current approaches to microbial monitoring on the ISS involve traditional plate culturing techniques. While these approaches could be deemed as indicators of water quality, they involve use of valuable crew time, and results are known after incubation times of 48–72 hours. Proposals are solicited for microbial monitoring technology development that not only provides the needed measurements in a timely manner, but is also efficiently compatible with and interfaces to existing flight hardware with minimal impact on current infrastructure.

### **AEMC Flight Experiments (see also Space Flight Experiments, Section II, Part D, of this Appendix)**

Microgravity effects can play a strong role for AEMC technologies in the space environment. Sensors that monitor or use liquids such as water generally face microgravity effects. Analysis of head space (the air space above a liquid sample) constituents, a common technique in ground-based laboratories, is problematic in microgravity.

Flight experiments should have as their objective the testing or validation of monitoring and control technologies in the space environment. Of interest is the monitoring and control of environmental parameters, including air/water major constituents and trace contaminants, as well as the microbial environment in air, in water, and on surfaces. Initial activities should focus on the evaluation of advanced environmental sensors and controls that will help to ensure crew health and safety while moving well beyond ISS baseline in terms of lower volume, minimal mass and power consumption, with increased sensitivity and less reaction time.

*Proposals outside the above areas of emphasis but within the scope of the AEMC Program Element will be accepted for review but may be given somewhat lower priority, at the discretion of NASA.*

## NASA Technical Contacts

In order for applicants to better understand NASA's scientific and technological needs, and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the NASA AEMC contact personnel listed below.

Charles J. Barnes, Ph.D.  
Code UB/Bioastronautics Division  
NASA Headquarters  
300 E Street SW  
Washington, DC 20546-0001  
Telephone: 202-358-2365  
E-mail: [cbarnes@hq.nasa.gov](mailto:cbarnes@hq.nasa.gov)

Darrell L. Jan, Ph.D.  
Jet Propulsion Laboratory  
MS 180-604  
4800 Oak Grove Drive  
Pasadena, CA 91109-8099  
Telephone: 818-354-4542  
E-mail: [djan@jpl.nasa.gov](mailto:djan@jpl.nasa.gov)

Investigators should refer to the Advanced Environmental Monitoring and Control Web site for additional information:

**<http://aemc.jpl.nasa.gov/>**

## Related Areas

In the area of *in-situ* environmental monitoring, this NRA solicits only Pilot Study proposals. Conventional proposals for low technology readiness level (TRL) research pertinent to *in-situ* monitoring of the environment will be solicited through the research announcement of the Office of Aerospace Technology. This announcement likely will be released in summer of 2003.

AEMC-related research in fluid physics and biotechnology is also being solicited through the Physical Sciences Research Division's Fluid Physics and Cellular and Macromolecular Biotechnology Programs, respectively. Collaborative research in these areas is encouraged. Details on current Physical Sciences research opportunities in these areas can be found online at

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-02-OBPR-03/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-03/index.html)**

## Supporting Documents

- Advanced Environmental Monitoring and Control Project Plan (1999)
  - Advanced Environmental Monitoring and Control Technology Development Requirements (1998)
  - Advanced Environmental Monitoring and Control Strategic Plan (1996)
  - Advanced Environmental Monitoring and Control Program: Technical Assessment Matrix
  - Advanced Environmental Monitoring and Control Roadmap (1999)
  - Advanced EVA Systems Roadmaps (JSC 2000)
- <http://www.jsc.nasa.gov/xa/advanced.html>**

- Advanced EVA Exploration Requirements (JSC 2000)  
<http://www.jsc.nasa.gov/xa/advanced.html>

Unless otherwise noted, these supporting documents can be accessed via the Internet at the following address:

[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)

## **B. Advanced Life Support (ALS)**

### **Program Element Description**

The ALS Program Element of the AHST Program develops technologies for advanced regenerative life support systems to support human missions in space. Such missions, including the ISS and possible future planetary exploration, may last from months to years. Resupply of life support materials is expensive and, in some cases, may be extremely difficult, necessitating greater self-sufficiency of the subsystems used on the mission. Integrated ground test facilities will be used for demonstrating, validating, and integrating physicochemical and biological subsystems that fully recycle air and water, recover resources from solid wastes, provide thermal control, and provide and process food (fresh or stored bulk ingredients, or pre-packaged) for the crew. Information regarding individual projects funded by the ALS Program Element is available through the OBPR Task Book at

[http://research.hq.nasa.gov/taskbook/tb2002/search/retrieve\\_taskbook.cfm](http://research.hq.nasa.gov/taskbook/tb2002/search/retrieve_taskbook.cfm)

(Select the “Advanced Life Support” Program Element on the Task Book search screen.)

### **Proposals Sought for FY 2004**

In all areas, proposals are sought that will dramatically advance the goals of increasing reliability and autonomy while reducing mass, power, volume, and crew time for an ALS subsystem. The equivalent system mass (ESM) of the life support system serves as a good aggregate measure of life support system performance and is critical in determining the cost of human space flight. Therefore, proposals that take into consideration ESM are particularly encouraged. Information about the ALS Metric can be found at

[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)

**For FY 2004, the ALS Program Element will emphasize**

#### **Pilot Studies**

Pilot Study proposals are solicited that focus on novel, high-risk research and technology concepts or approaches applicable to ALS Element areas of Water Recovery, Air Revitalization, and Solid Waste Management. The proposed work must have the potential to

dramatically reduce the required mass, power, volume, crew time, and increase the safety and reliability associated with an ALS subsystem. The intent and scope of the proposal, including the organization of the research team, must comply with the description of Pilot Studies detailed in Section II, Part A, of this Appendix.

## **Conventional Studies**

### Solid Waste Management

Waste processing methods are needed for management of solid wastes that include human metabolic wastes, paper and plastic products, uneaten food, small amounts of inedible plant biomass, and other waste solids likely to be generated in a space-based vehicle and early planetary surface habitats. Examples of solid waste processing technologies include volume reduction, de-watering, stabilization, and safe storage and handling methods.

### Biological Wastewater Processing

Wastewater (*i.e.*, urine, atmospheric humidity condensate, and water used for hygiene purposes) represents the largest projected waste stream in human spacecraft. Biological processes are predominantly used to process terrestrial wastewater streams due to their lower cost relative to physical chemical systems, and may prove to be an efficient approach for recycling water on long duration human space missions. The major transformations of concern are microbial conversion and mineralization of high levels of organic carbon, urea, and ammonia. The levels of certain trace organic contaminants within wastewater (*e.g.*, antibiotics, other pharmaceuticals or naturally-occurring hormones excreted in urine, or soaps and other hygiene products) may also have an impact on bioreactor performance or have significant impact upon effluent quality. Development of techniques that are applicable to biological wastewater processing and the manipulation of physico-chemical factors that will lead to process optimization are solicited.

### Systems Integration, Modeling, and Analysis

Advanced regenerative life support systems are inherently more complex than traditional Environmental Control and Life Support Systems (ECLSS), may include combinations of many different physicochemical and biological processors, may require complex control architectures, and are expected to perform for long periods of time (months to years) away from Earth. Little is known about the reliability and risk associated either with advanced life support systems or the differences between biological and physico-chemical systems. Investigations are solicited in the areas of reliability, probabilistic risk assessment, failure modes and effects analysis, and risk mitigation and reliability improvement. In addition, studies of predictive modeling for systems optimization are of interest.

## **Rapid Technology Development Teams**

Technologies are sought that provide closure to air and water regeneration loops or that contribute to solid waste management and resource recovery. Of particular interest are technologies that are functionally equivalent to those identified in life support concepts for Transit Vehicles, Surface Habitat Landers, and Evolved Surface Base architectures as described in the Advanced Life Support Systems Integration, Modeling and Analysis Reference Missions Document, JSC 39502 Rev.A (2001). Examples of technology development efforts in the aforementioned areas include 1) processors for water recovery from brines generated by other technologies that are part of water processing systems; 2) technologies for volume reduction, stabilization, and recovery of resources (including water) from solid wastes and waste byproducts; and 3) advanced technologies for air revitalization applicable to ALS and AEVA, including carbon dioxide and trace contaminant removal. Proposals should demonstrate knowledge of current technologies under development and in use on the ISS and Shuttle, clearly define the expected product and the approach by which it will be developed, and clearly explain how the anticipated decreases in Equivalent System Mass (ESM) will be obtained and demonstrated.

### **ALS Flight Experiments (see also Space Flight Experiments, Section II, Part D, of this Appendix)**

Microgravity effects can play a strong role in ALS technologies in the space environment. Life support technologies for processing air, water, and solid waste involving multi-phase flows would require validation in the microgravity environment. Current approaches to recycle air and water on the ISS have penalties of mass, power, or volume associated with their performance. Ground-based research on advanced life support has focused on decreasing the mass, power, and volume constraints, but microgravity performance of these technologies is dependent upon overcoming the multi-phase issues. Therefore, ALS solicits proposals to examine the gravitational sensitivity of candidate life support processes, components, and subsystems and to demonstrate the performance and functionality of mature technologies.

Flight proposals that will have the potential to dramatically reduce the required mass, power, volume, crew time, and increase the safety and reliability associated with an ALS subsystem are sought. However, particular needs in the following areas are recognized: Air Revitalization (e.g., biological and physicochemical trace contaminant removal); Water Recovery (e.g., physicochemical and biological water processors, oxygenators and gas-liquid separators); Solid Waste Management (e.g., biological and physicochemical methods for volume reduction, stabilization and resource recovery); and Advanced Thermal (e.g., evaporation/condensation, and two phase flow) and Crop Production Systems (e.g., vegetable production unit development).

*Proposals outside the above areas of emphasis but within the scope of the ALS Program Element will be accepted for review but may be given somewhat lower priority, at the discretion of NASA.*

## **NASA Technical Contacts**

Due to the applied nature of the ALS Program Element, proposals are solicited by this Announcement primarily for technology development and applied (rather than fundamental) research. Research undertaken and technologies developed for ALS tend to find ready application and rapid integration into NASA's ongoing programs.

In order for applicants to better understand NASA's scientific and technological needs and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the NASA ALS personnel listed below.

Charles J. Barnes, Ph.D.  
Code UB/Bioastronautics Division  
NASA Headquarters  
300 E Street SW  
Washington, DC 20546-0001  
Telephone: 202-358-2365  
E-mail: cbarnes@hq.nasa.gov

B. Michael Lawson  
Mail Code EC  
NASA Johnson Space Center  
2101 NASA Road One  
Houston, TX 77058  
Telephone: 281-483-9124  
E-mail: b.m.lawson@nasa.gov

For additional information, investigators should refer to the Advanced Life Support Web site at

**<http://advlifesupport.jsc.nasa.gov/>**

## **Related Areas**

Related research in fluid physics and biotechnology is also being solicited through the Physical Sciences Research Division's Fluid Physics and Cellular and Macromolecular Biotechnology Programs, respectively. Collaborative research in these areas is encouraged. Details on current Physical Sciences research opportunities in these areas can be found online at

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-02-OBPR-03/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-02-OBPR-03/index.html)**

Proposals for research of a more fundamental nature, such as biochemical, molecular or genetic research in support of Advanced Life Support technologies, should be submitted to the Fundamental Space Biology Research Program. Fundamental Space Biology NASA Research Announcements and supporting information can be found at

**[http://research.hq.nasa.gov/code\\_u/code\\_u.cfm](http://research.hq.nasa.gov/code_u/code_u.cfm)**

## **Supporting Documents**

Further information about the ALS Program Element can be found in the following documents.

- Advanced Life Support Project Plan, JSC-39168 (2002)

- Advanced Life Support Requirements Document, JSC-38571B (2002)
- Advanced Life Support Technology Assessment Matrix (1998)
- ALS Roadmap (1998)
- ALS Metric (2002)
- Baseline Values and Assumptions Document, JSC-47804 (2002)
- Advanced Life Support Systems Integration, Modeling and Analysis Reference Missions Document, JSC 39502 Rev.A (2001)
- Advanced Technology for Human Support in Space: NRC Report (1997)

These supporting documents can be accessed via the Internet at the following address:

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

## C. Space Human Factors Engineering (SHFE)

### **Program Element Description**

The Space Human Factors Engineering (SHFE) Program Element of the AHST Program is designed to integrate knowledge about human capabilities and system-engineering methodologies into spacecraft design, mission planning, and related ground operations. The SHFE Program Element also encourages the development of new processes and procedures; draws on human factors expertise in aeronautics to optimize crew training, automated systems design, proficiency, and productivity; and uses relevant analog studies in simulators as well as in extreme and isolated environments. Information regarding individual projects funded by the SHFE Program Element is available through the OBPR Task Book at

**[http://research.hq.nasa.gov/taskbook/tb2002/search/retrieve\\_taskbook.cfm](http://research.hq.nasa.gov/taskbook/tb2002/search/retrieve_taskbook.cfm)**

(Select the “Space Human Factors Engineering” Program Element on the Task Book search screen.)

### **Proposals Sought for FY 2004**

This NRA specifically addresses those SHFE Program Element activities that are given below:

#### **Pilot Studies**

##### Habitability and Work Environment

Proposals for pilot studies are solicited for the area of **habitability and work environment** as described in the Conventional Studies section. These proposals should identify ways to answer questions about how habitability factors such as free volume, lighting, noise, privacy, variety of food, etc. affect crew performance over time. Proposals may address individual factors or factors in combination. Tools or techniques to systematically address this topic may be proposed. The emphasis is on identifying ways to reliably evaluate factors that are difficult to quantify.

#### Human Interface Design Process

Pilot studies focusing on technologies to **improve the process of designing human-system interfaces** are solicited. Specifically, proposals to develop tools or methods that enable incorporating human factors requirements and best practices into designs, without requiring designers to have significant training in human factors engineering, are solicited.

Also, pilot studies for computer models that merge capabilities from jointed/flexible human models and three-dimensional anthropometric scanning are encouraged.

### **Conventional Studies**

#### Habitability and Work Environment

Methods for objectively or quantitatively measuring habitability features are needed. Studies to predict the effects of combinations of habitability-related issues (e.g., noise, visual environment, privacy) on spaceflight crew performance and safety are solicited.

#### Workload and Task Characteristics

Proposals are solicited for non-intrusive methods of workload assessment that enable understanding of the effects of levels of workload on performance, and for development of models that predict the effects of various workloads on human performance. Emphasis is placed on measuring the effects of task allocation between humans and automated systems on crew and system performance.

#### Mission Support, Maintenance, and Logistics

Proposals are solicited for technologies in support of malfunction diagnoses and emergency procedures and that focus awareness of systems health, maintenance procedures, and maintenance histories. Other areas of focus are human and intelligent systems for maintaining vehicle/mission system health, crew aiding/training technologies that support nominal and off-nominal situations, and maintenance and procedures that support the crew in handling autonomous malfunction diagnoses.

### **Rapid Technology Development Teams**

#### ISS Remote Manipulator Operations

SHFE has been supporting research in virtual reality, teleoperation, and augmented reality for a number of years. Proposals to develop products that will increase the safety and productivity of remote manipulator operations in the ISS are solicited. Proposed work should lead to tools or procedures that decrease operator workload, or that decrease crew time required to perform actual remote operations on orbit. These proposals must include plans to validate expected improvements.

### Adaptive Training and Procedure Interfaces

On-board ISS operations include tasks that are repeated often for both maintaining ISS systems and completing scientific studies. We request proposals to integrate procedure development, and training and aiding strategies and technologies, into a demonstration of embedded training in a procedural interface that is scalable, changing with the astronauts' information requirements. Proposed work should lead to a task support tool that allows for different levels of task familiarity and information needs. Proposals must address ground demonstration and evaluation using a space-flight application. Proposals must address validation of the effectiveness of the procedural interface for various levels of familiarity of the user with the task.

### **SHFE Flight Experiments (see also Space Flight Experiments, Section II, Part D, of this Appendix)**

The space flight environment affects human performance in many ways that cannot be simulated on Earth. The microgravity environment affects physical posture and requires major changes to physical crew interfaces. The isolation and confinement, combined with the special risks of the space environment, lead to unique challenges in designs for equipment, habitat, and environment for living and working. The distribution of tasks between Mission Control Center and on-board crew members requires novel applications of technology to enable sharing information, providing just in time training, and ensuring error-free communication.

Flight experiments should address any one or combination of these unique aspects of living and working in space. Projects leading to results that can be incorporated into mission planning rules, requirements documents, or hardware or software tools are of special interest.

*Proposals outside the above areas of emphasis but within the scope of the SHFE Program Element will be accepted for review but may be given somewhat lower priority, at the discretion of NASA.*

### **NASA Technical Contacts**

In order for applicants to better understand NASA's scientific and technological needs, and to enable more effective transfer of their scientific and technological advances to NASA, it would be advantageous for applicants to explore opportunities to interact with the following NASA Space Human Factors Engineering personnel:

Charles J. Barnes, Ph.D.  
Code UB/Bioastronautics Division  
NASA Headquarters  
300 E Street SW  
Washington, DC 20546-0001  
Telephone: 202-358-2365  
E-mail: cbarnes@hq.nasa.gov

Barbara Woolford  
Mail Code SF  
NASA Johnson Space Center  
2101 NASA Road One  
Houston, TX 77058  
Telephone: 281-483-3701  
E-mail: barbara.j.woolford@nasa.gov

Investigators should refer to the following Web site for additional information:

**<http://jsc-web-pub.jsc.nasa.gov/fpd/>**

### **Supporting Documents**

Further information about the SHFE Program Element can be found in the following documents:

- SHFE Project Plan
- SHFE Project Implementation Plan (2002-2003)
- SHFE Roadmap (1998)
- SHFE Critical Research & Technology Definition (1996)

These supporting documents can be accessed via the Internet at the following address:

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

## **Application Procedures and Selection Process**

Except where specifically stated otherwise in this NRA, applicants must prepare proposals in accordance with the “Instructions for Responding to NASA Research Announcements,” which is part of the NASA Federal Acquisition Regulations (FAR) Supplement (NFS), Part 1852.235-72 (APPENDIX D).

### **I. Instructions for Notices of Intent and Proposal Submission**

#### **A. SYS-EYFUS Registration**

SYS-EYFUS is an electronic system used by NASA Headquarters to manage research solicitation activity, plan for the receipt of research proposals, track the receipt and peer evaluation of these proposals, and manage funded research (grants, cooperative agreements, etc.) sponsored by NASA’s Office of Equal Opportunity (Code E), Office of Earth Science (Code Y), Office of Human Resources & Education Division (Code F), Office of Biological and Physical Research (Code U), Office of Space Science (Code S), and the Office of Space Flight (Code M). SYS-EYFUS also supports the funding and administration of awards pursuant to selection of these research opportunities.

The SYS-EYFUS Help Desk is available at (202) 479-9376. Help desk hours are from 8 a.m. to 6 p.m. Eastern Time.

All investigators planning to submit a proposal to this solicitation are requested to register online with SYS-EYFUS. Comprehensive help, instructions, and contact information are provided online. SYS-EYFUS can be accessed at the following Web address:

**<http://proposals.hq.nasa.gov/proposal.cfm>**

If you have previously registered with SYS-EYFUS, you are asked to verify and update your user information. If you have forgotten your user ID or password, select the “Forgot Your Password” option and type in your first and last name to search our database. The system will send an automatic e-mail message with your username and password to the e-mail address listed in our database.

## B. Instructions for Preparing a Notice of Intent

All investigators planning to submit a proposal in response to this solicitation are requested to submit a **non-binding** notice of intent (NOI) to propose by the due date identified in the Summary and Supplemental Information Section of this NRA via the Web at the following address:

**<http://proposals.hq.nasa.gov/proposal.cfm>**

- 1) Login to SYS-EYFUS at the URL listed above and select “New Notice of Intent.”
- 2) The Division Specific Opportunities screen will appear. In the selection window, highlight **Bioastronautics Research Division** and click on “Continue.”
- 3) The List of Existing Opportunities screen will appear. In the selection window, highlight **03-OBPR-01** and then click on “Continue.”
- 4) This will bring you to the Notice of Intent Submission Form. **All fields are required.**
  - a. For the proposal type field on this form, please select from **only** the following options:
    - Ground-New/No Prior Support
    - Ground-New/Prior Support
    - Ground-Revised
    - Pilot Study- New/No Prior Support
    - Pilot Study- New/Prior Support
    - Pilot Study-Revised
    - RTD Team-New/No Prior Support
    - RTD Team-New/Prior Support
    - RTD Team-Revised
    - Flight-New/No Prior Support
    - Flight-New/Prior Support
    - Flight-Revised

Ground, Pilot Study, RTD Team (i.e., Rapid Technology Development Team), and Flight refer to the proposal types described in Appendix A Sections II.A, II.B, II.C, and II.D, respectively. New/no prior support means that the investigator **has not** received NASA funding from 2000 through 2002, new/prior support means that the investigator **has** received NASA funding between 2000 and 2002, and revised means that the proposal is a revised version of a proposal submitted to NASA and reviewed from 2000 through 2002, but not funded. A proposal previously submitted but not funded should be identified as being “revised” even if the original Principal Investigator has changed.

- 5) Click on “Submit NOI Page.”
- 6) The Team Member Page screen will appear, where you can add or remove team members. Select continue if there are no other team members. To add a team member, highlight the role option on the selection list, type in first and last name and click on search... When the resulting set appears, choose the appropriate radio button and click on ADD to add the person to the NOI. After you are done, click on “Continue.” **IMPORTANT:** If the team member is not listed in our database, please have them add themselves as a new user to the system. You may then add them to your team member list.
- 7) After continuing from the Team Members Page, your NOI will be displayed. Click on “Resubmit NOI Page” to complete your NOI submission.
- 8) You may edit and resubmit your NOI at any time before the submission deadline of April 14, 2003. Once you submit an NOI, it cannot be deleted, only edited. For title, team member, or any other changes, please edit your existing NOI and resubmit changes to avoid duplicate records.

### C. Instructions for Preparing and Electronically Submitting a Proposal Cover Page

All investigators planning to submit a proposal in response to this solicitation must electronically submit proposal cover page information online and provide a hardcopy of the cover page attached to each proposal copy by the due date indicated in the Summary and Supplemental Information Section of this NRA. The proposal cover page can be submitted and printed via the Web at the following address:

**<http://proposals.hq.nasa.gov/proposal.cfm>**

- 1) Login to SYS-EYFUS at the URL listed above.
- 2) To submit a New Proposal Cover Page, click the “New Proposal Cover Page” option on the SYS-EYFUS Options screen, and the New Proposals Cover Page screen will appear.
- 3) If you previously submitted an NOI in response to this solicitation, choose to carry over the existing NOI. This option will populate the cover page fields with the NOI information. Edit the information as necessary, click “Continue,” and proceed to #8 below.
- 4) If you did not previously submit an NOI, click on New Proposal Cover Page option, and the Division Specific Opportunities screen will appear.
- 5) In the selection window, highlight **Bioastronautics Research Division** and click on

“Continue.”

- 6) The List of Existing Opportunities screen will appear. In the selection window, highlight **03-OBPR-01** and then click on “Continue.”
- 7) This will bring you to the Proposal Cover Page Submission Form. Fill in all the fields. All fields are required.
  - a. For the proposal type field on this form, please select from **only** the following options:
    - Ground-New/No Prior Support
    - Ground-New/Prior Support
    - Ground-Revised
    - Pilot Study- New/No Prior Support
    - Pilot Study- New/Prior Support
    - Pilot Study-Revised
    - RTD Team-New/No Prior Support
    - RTD Team-New/Prior Support
    - RTD Team-Revised
    - Flight-New/No Prior Support
    - Flight-New/Prior Support
    - Flight-Revised

Ground, Pilot Study, RTD Team (i.e., Rapid Technology Development Team), and Flight refer to the proposal types described in Appendix A Sections II.A, II.B, II.C, and II.D, respectively. New/no prior support means that the investigator **has not** received NASA funding from 2000 through 2002, new/prior support means that the investigator **has** received NASA funding between 2000 and 2002, and revised means that the proposal is a revised version of a proposal submitted to NASA and reviewed from 2000 through 2002, but not funded. A proposal previously submitted but not funded should be identified as being “revised” even if the original Principal Investigator has changed.

- b. Indicate the status of IRB/IACUC for your proposal. If IRB or IACUC review is unavoidably delayed beyond the submission of the application, enter “Pending” on the Proposal Cover Page, and be advised that the certification must be received within 90 days after the due date for which the application is submitted.
    - c. Provide your TIN and CAGE numbers. Every U.S. institution that submits a proposal to a U.S. agency must provide their permanently-assigned Taxpayer Identification Number (TIN) and must register with the Department of Defense Central Contractor Registration (CCR) database for a permanently-assigned Commercial and Government Entity (CAGE) number. Please reference the 2003 NRA Proposers Guidebook for additional information.

**<http://www.hq.nasa.gov/office/procurement/nraguidebook>**

Click on “Continue.”

- 8) The Team Member Page screen will appear, where you can add or remove team members. Select “Continue” if there are no other team members. To add a team member, highlight the role option on the selection list, type in first and last name and click on search. When the resulting set appears, choose the appropriate radio button and click on ADD to add the person to the proposal. After you are done, click on “Continue.”

**You must include your authorizing official as a team member.** When you complete and print the proposal cover page, you will see signature blocks both for yourself and your authorizing official. You are required to submit one original signed (by both you and your authorizing official) cover page with your proposal hardcopies.

**IMPORTANT:** If the team member is not listed in our database, please have them add themselves as a new user to the system. You may then add them to your team member list.

- 9) After continuing from the Team Member Page, the Proposal Options Page appears.
- 10) Please fill out the budget form by clicking on the “Budget” button, filling in project costs, and clicking “Continue.” This will bring you to the Proposal Budget Review Page. Click “Continue” if the information is correct.
- 11) After verifying your budget information, you will be returned to the Proposal Options Page. Click the “Show/Print” button.
- 12) For detailed budget information, please download template forms located at

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

These forms cannot be electronically submitted. Fill out the forms and attach them to your proposal.

- 13) At the page entitled Proposal Information Item List, click “Continue” to preview your Proposal Cover Page. Print the cover page from your Internet browser once you have reviewed the information. The cover page must be signed by both the Principal Investigator and the authorizing official and attached to the front of your proposal before submission of hard copies to NASA.

By signing and submitting the proposal identified on the cover sheet, the Authorizing Official of the proposing institution (or the individual investigator if there is no

proposing institution): 1) certifies that the statements made in the proposal are true and complete to the best of his/her knowledge; 2) agrees to accept the obligations to comply with NASA Award terms and conditions if an award is made as a result of this proposal; 3) provides certification to the following that are reproduced in their entirety in Appendix C of this NRA: (i) Certification Regarding Debarment, Suspension and Other Responsibility matters, (ii) Certification Regarding Lobbying, and (iii) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs.

- 14) You may edit and resubmit your proposal cover page at any time before the submission deadline as indicated in the Summary and Supplemental Information Section of this NRA. Please note that once you submit a proposal cover page, it can only be edited, not deleted. For title, team member, budget or any other changes, please edit your existing proposal cover page and resubmit changes to avoid duplicate records.

#### D. Instructions for Preparation and Delivery of Proposals

**All** proposals submitted must include the completed cover page form as described in this Appendix. The name of the Principal Investigator should appear in the upper right hand corner of each page of the proposal, except on the cover page form, where special places are provided for this information. Note that the proposal must specify the period of performance for the work described; periods of performance may be for any duration up to the maximum duration identified in the “Summary and Supplemental Information” section of this NRA but should be suitable for the project proposed.

##### **The proposal must include the following material, in this order:**

- (1) Proposal Cover Page: Solicited Proposal Application, including certification of compliance with U.S. code (if applicable). One signed original required. Please see “Instructions for Preparing and Electronically Submitting a Proposal Cover Page” (Appendix B, Section I, Part C) for instructions on how to complete the proposal cover page information.
- (2) Transmittal Letter or Prefatory Material, if any (see “Instructions for Responding to NASA Research Announcements” for details).
- (3) Proposal Title Page, with Notice of Restriction on Use and Disclosure of Proposal Information, if any (see “Instructions for Responding to NASA Research Announcements,” for details).
- (4) A one-page justification on how the proposed research satisfies the unique requirements of the AHST program in general and the research element in particular. The justification should include reference to relevant risks identified in the Critical Path Roadmap that the proposed research might mitigate. The Critical Path Roadmap is available at:

**<http://criticalpath.jsc.nasa.gov/>**  
(Follow links to appropriate discipline area.)

#### (5) Project Description

The length of the Project Description section of the proposal cannot exceed 20 pages (i.e., 20 sides) using regular (12 point) type. Text should be printed double-sided for proposal copies and one-sided for the signed original, and should have the following margins: left, right = 1.25"; top, bottom = 1.0". Referenced figures must be included in the 20 pages of the Project Description. The Bibliography section is not considered part of the 20-page project description. Proposals that exceed the 20-page limit for the project description (22-page limit for revised proposals; see below) will not be reviewed. The proposal should contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with current resources and the resources requested. In addition, the proposal should clearly indicate the relationship between the proposed work and the research emphases defined in this Announcement. Reviewers are not required to consider information presented as appendices or to view and/or consider Web links in their evaluation of the proposal.

New applications where the investigator has received NASA funding in related fields from 2000 through 2002: Results and evidence of progress of the associated NASA supported research must be presented as part of the project description. See "Instructions for Responding to NASA Research Announcements" for details.

Revised applications (revisions of 2000, 2001 or 2002 submissions) must be so designated on the proposal cover page and explained in the project description. This explanation should be presented in a separate section of **no more than two pages at the beginning of the project description**, and is in addition to the 20 pages allowed for the project description. Related changes to the research plan should be highlighted in the body of the project description. Changes within the proposal may be highlighted by appropriate bracketing, indenting, or changing of typography. Clearly present any work done since the prior version was submitted. **Revised applications that do not address the criticisms in the previous review will be considered non-compliant and will be returned without review.** See "Instructions for Responding to NASA Research Announcements" for additional information.

#### (6) Management Approach

Each proposal must specify a single Principal Investigator who is responsible for carrying out the proposed project and coordinating the work of other personnel involved in the project. In proposals that designate several senior professionals as key participants in the research project, the management approach section should define the roles and responsibilities of each participant and note the proportion of each

individual's time to be devoted to the proposed research activity. The proposal must clearly and unambiguously state whether these key personnel have reviewed the proposal and endorsed their participation.

Co-Principal Investigators are not permitted with the sole exception when a non-U.S. Co-Investigator is proposed. This exception is described in the Co-Investigator subcategories below.

Investigators are strongly encouraged to identify only the most critically important personnel to aid in the execution of their proposals. Should such positions be necessary, Co-Investigators (CO-Is) may be identified who are critical for the successful completion of research through the contribution of unique expertise and/or capabilities, and who serve under the direction of the PI, regardless of whether or not they receive compensation under the award. Most NRAs require a Co-I to have a well-defined role in the research that is defined in the Management section of the proposal. Evidence of a Co-I's commitment to participate is often requested through a brief letter to be included with the proposal.

There are three subcategories of Co-Is that a proposal may identify, as appropriate:

- A Co-I may be designated as the Science PI for those cases where the proposing institution does not permit that individual to formally serve as the PI as defined above. In such a case, the Science PI will be understood by NASA to be in charge of the scientific direction of the proposed work, although the formally designated PI is still held responsible for the overall direction of the effort and use of funds.
- A Co-I may be designated as an Institutional PI when their institution is making a major contribution to a proposal submitted by a PI from another institution.
- A Co-I from a non-U.S. institution may be designated as a Co-Principal Investigator (Co-PI) should such a designation serve required administrative purposes in that Co-I's institution and/or for the procurement of funding by that Co-I from their sponsoring funding authority.

Additional category positions are often included in proposals as defined as follows:

A Postdoctoral Associate holds a Ph.D. or equivalent degree and is identified as a major participant in the execution of the proposed research. Such personnel may be identified by name or only by function in those cases where their recruitment depends on the successful selection of the proposal.

Other Professional is a description appropriate for personnel who support a proposal in a critical albeit intermittent manner, such as a consulting staff scientist or a key

Project Engineer and/or Manager, who is not identified as a Co-I or Postdoctoral Associate.

A Graduate Student included in a proposal is working for a post-graduate degree and will support the proposed research under direction of the PI. Such a student may be identified by name or only by function in case their recruitment depends on the successful selection of the proposal.

A Collaborator is an unfunded position included in a proposal, whose participation is less critical than a Co-I, but who is committed to provide a specific contribution to the proposal.

(7) Personnel/Biographical Sketches

The biographical sketch for each investigator should not exceed two pages. If the list of qualifications and publications exceeds two pages, select the most pertinent information (see “Instructions for Responding to NASA Research Announcements” for details). **Please use the biographical sketch form provided at**

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

These forms cannot be electronically submitted. Fill out the forms and attach them to your proposal.

(8) Facilities and Equipment (see “Instructions for Responding to NASA Research Announcements” for details)

(9) Special Matters (specific information on animal or human subjects protocol approval required, if applicable)

For proposals employing human subjects and/or animals, assurance of compliance with human subjects and/or animal care and use provisions is required on the Proposal Cover Page. In addition, the application must include a statement from the applicant institution certifying that the proposed work will meet all Federal and local human subjects requirements and/or animal care and use requirements.

Policies for the protection of human subjects in NASA sponsored research projects are described in NASA Management Instruction (NMI) 7100.8B (*Protection of Human Research Subjects*). Animal use and care requirements are described in the NASA Code of Federal Regulations (CFR) 1232 (*Care and Use of Animals in the Conduct of NASA Activities*). Both documents are available from the Office of Biological and Physical Research, Code UB, NASA Headquarters, Washington, DC 20546.

Additional Requirements for Research Employing Human Subjects

A letter signed by the Chair of the Institutional Review Board (IRB) identifying the proposal submitted to NASA by title and certifying approval of proposed human subjects protocols and procedures should be included with each copy of the proposal. IRB certifications for other research proposals or grants cannot be substituted (even if they employ the same protocols and procedures).

If IRB certification is pending on the proposal due date, select “pending” from the IRB/IACUC section menu on the Proposal Cover Page, and include with each copy of the proposal a letter signed by the IRB Chair identifying the proposal by title and indicating the status of the IRB review process at the time of submission. IRB certification must be received no later than 90 days after the proposal due date. An application lacking the required IRB certification 90 days after the proposal due date will be considered incomplete and may be returned to the applicant without review.

With regard to research involving human subjects, NASA has adopted the National Institutes of Health (NIH) policy. Women and members of minority groups and their subpopulations must be included in NASA-supported biomedical and behavioral research projects involving human subjects, unless a clear and compelling rationale and justification is provided showing that inclusion of these groups is inappropriate with respect to the health of the subjects or the purpose of the research.

NASA will require current IRB certification prior to each year’s award.

#### Additional Requirements for Research Employing Animals

**Specific information describing and justifying the use of animal subjects must be included in the proposal.**

A letter signed by the Chair of the Institutional Animal Care and Use Committee (IACUC) identifying the proposal submitted to NASA by title and certifying approval of the proposed animal research protocols and procedures should be included with each copy of the proposal. The institution’s Public Health Service Animal Welfare Assurance Number must be included on the IACUC certification and entered in the IRB/IACUC section of the Proposal Cover Page. IACUC certifications for other research proposals or grants cannot be substituted (even if they employ the same protocols and procedures).

If IACUC certification is pending on the proposal due date, select “pending” from the IRB/IACUC selection menu on the Proposal Cover Page, and include with each copy of the proposal a letter signed by the IACUC Chair identifying the proposal by title and indicating the status of the IACUC review process at the time of submission. IACUC certification must be received no later than 90 days after the proposal due date. An application lacking the required IACUC certification 90 days after the proposal due date will be considered incomplete and may be returned to the applicant

without review.

NASA will require current IACUC certification prior to each year's award.

(10) Detailed Budget and Supporting Budgetary Information

**For detailed budget information, please use the forms provided at**

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

These forms cannot be electronically submitted. Fill out the forms and attach them to your proposal.

NASA is expected to be operating on the basis of full cost accounting as soon as possible, including all Civil Service salaries with overhead. In the interim period, proposals should use the accounting method authorized at their institutions at the time proposals are due and for the entire proposed period of performance. Funds to support the Resident Research Assistant (RRA) Postdoctoral Program costs (e.g., stipend, travel, computer time, supplies, etc.) are to be budgeted within the NASA intramural Principal Investigator budget.

If travel is planned, the proposal budget should include appropriate travel funds for visits to NASA field centers (as appropriate) and presentation of findings at professional society meetings.

In this solicitation, the terms "cost" and "budget" are used synonymously. Sufficient proposal cost detail and supporting information are required; funding amounts proposed with no explanation (e.g., Equipment: \$1,000, or Labor: \$6,000) may cause delays in evaluation and award. Generally, costs will be evaluated for realism, reasonableness, allowability, and allocation. The budgetary forms define the desired detail, but each category should be explained. Offerors should exercise prudent judgment in determining what to include in the proposal, as the amount of detail necessarily varies with the complexity of the proposal.

The following examples indicate the suggested method of preparing a cost breakdown:

Direct Labor

Labor costs should be segregated by titles or disciplines with estimated hours and rates for each. Estimates should include a basis of estimate, such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess cost reasonableness by various means including comparison to similar skills at other organizations.

### Other Direct Costs

Please detail, explain, and substantiate other significant cost categories as described below:

- Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.
- Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and the rates of pay.
- Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General-purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.
- Supplies: Provide general categories of needed supplies, the method of acquisition, and estimated cost.
- Travel: Describe the purpose of the proposed travel in relation to the grant, and provide the basis of estimate, including information on destination and number of travelers (if known).
- Other: Enter the total of direct costs not covered by a) through e). Attach an itemized list explaining the need for each item and the basis for the estimate.

### Indirect Costs

Indirect costs should be explained to an extent that will allow the Government to understand the basis for the estimate. Examples of prior year historical rates, current variances from those rates, or an explanation of other basis of estimates should be included. Where costs are based on allocation percentages or dollar rates, an explanation of rate and application base relationships should be given. For example, the base to which the General and Administrative (G&A) rate is applied could be explained as: application base equals total costs before G&A less subcontracts. All awards made as a result of this NRA maybe funded as grants or contracts. However, while proposals submitted by “for profit” organizations are allowed, they cannot include a “fee.”

- (12) Appendices, if any (**reviewers are not required to consider information presented in appendices**)
- (13) One (1) signed original and twenty (20) copies of the proposal cover page and the proposals must be received by **4:30 p.m. (Eastern Time), June 13, 2003**, at the following address:

NASA Peer Review Services  
SUBJECT: 03-OBPR-01, AHST Research Proposal  
500 E Street SW  
Suite 200  
Washington, DC 20024  
(202) 479-9030

## II. Proposal Evaluation and Awards Selection Process

The following information is specific to this NRA and **supersedes** the information contained in paragraphs (i) and (j) of “Instructions for Responding to NASA Research Announcements.”

### A. Compliance Matrix

All proposals must comply with the general requirements of the Announcement as described in both Appendices B and “Instructions for Responding to NASA Research Announcements.” Appendix B contains specific requirements and explanations for each section of the proposal above and beyond NASA-specified requirements. “Instructions for Responding to NASA Research Announcements” outlines the NASA-specified requirements for proposal submission and should be used for clarification and reference. Upon receipt, proposals will be reviewed for compliance with the requirements of this Announcement. This includes

1. Submission of complete proposals specified in this Announcement. Proposals must be responsive to the areas of program element emphasis described in this Announcement and include a project description that is not more than 20 pages (i.e., 20 sides) in length.
2. Submission of appropriate Institutional Review Board (IRB) or Animal Care and Use Committee (ACUC) certification for all proposals using human or animal test subjects.
3. Submission of a budget that is within the guidelines specified in this Announcement and is for a funding period not exceeding that described in the Announcement.
4. Proposals that are revised versions of proposals previously submitted to NASA must be clearly designated as such on the proposal cover page and must contain an explanation of how the revised proposal has addressed criticisms from previous NASA review. This explanation should be presented in a separate section of **no more than two pages at the beginning of the project description** and is in addition to the 20 pages allowed for the project description. Related changes to the research plan should be highlighted in the body of the project description.
5. Submission of all other appropriate information as required by this NASA Research Announcement (refer to Section I, Appendix B).

*Note: At NASA’s discretion, non-compliant proposals may be withdrawn from the review process and returned to the investigator without further review.*

Compliant proposals submitted in response to this Announcement will undergo an intrinsic scientific or technical merit review. Only those proposals most highly rated in the merit review process will undergo additional reviews for program relevance and cost.

## B. Intrinsic Scientific or Technical Merit Review and Evaluation Criteria

The first review tier will be a merit review by a panel of scientific or technical experts. The number and diversity of experts required will be determined by the response to this NRA and by the variety of disciplines represented in the proposals relevant to the research emphases described in Appendix A. The merit review panel will assign *a score from 0-100* based upon the intrinsic scientific or technical merit of the proposal. This score will reflect the consensus of the panel.

The score assigned by this panel *will not be affected by the cost of the proposed work nor will it reflect the programmatic relevance of the proposed work to NASA*. However, the panel will be asked to include in their critique of each proposal any comments they may have concerning the proposal's budget and relevance to NASA.

Reviewers will be asked to consider the following five criteria for each proposal. Panelists are instructed to address and consider each of these five criteria in assigning the overall score; however, review panels are given considerable latitude in integrating the evaluation of these criteria into a final score.

- **Innovation:** Does the project employ novel concepts, approaches, or methods? Are the aims original and innovative? Does the project challenge existing paradigms or develop new methodologies or technologies?
- **Significance:** Does this study address an important problem? If the aims of the application are achieved, how will knowledge or technology be advanced? What will be the effect of these studies on the concepts, methods, or products that drive this field?
- **Approach:** Are the conceptual framework, design, methods, and analyses adequately developed, well integrated, and appropriate to the aims of the project? Is the proposed approach likely to yield the desired results? Does the applicant acknowledge potential problem areas and consider alternative tactics? Is the proposal high-risk and high-payoff? Is it likely that the proposed implementation timeline will be met?
- **Investigator:** Is the investigator appropriately trained and well suited to carry out this work? Is the work proposed appropriate to the experience level of the principal investigator and any co-investigators? Is the evidence of the investigator's productivity satisfactory?
- **Environment:** Does the scientific environment in which the work will be performed contribute to the probability of success? Do the proposed experiments take advantage of unique features of the scientific environment or employ useful collaborative arrangements? Is there evidence of institutional support?

## C. Feasibility of Implementation Review

*This review will be conducted only for the most highly rated proposals from the **merit** review.*

The Feasibility of Implementation Review will be conducted, appropriate to the TRL level of the research proposed, by an engineering and technical review team assembled by NASA. For Pilot Studies, Feasibility of Implementation will look for potential critical problems, evident in the idea itself, which could render the research unfeasible for use by NASA. For longer-term or more mature proposals, evaluation for the feasibility of implementation of the results of the proposed work (i.e., the resulting technology or research results) into an operational NASA system will be conducted. This review team will evaluate the feasibility of implementing the resulting technology or research results utilizing available NASA flight and/or ground facilities. Please refer to the **Space Life Sciences Ground Facilities Information Package** available at:

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

The purpose of the feasibility of implementation review is to assess the likelihood that the proposed research, if completed successfully, would lend itself to continued research and technology development in the context of the AHST Program goals.

## D. Flight Feasibility Review

*This review will be conducted only for the most highly rated flight experiment proposals from the **merit** review.*

The Flight Feasibility Review is an evaluation of the feasibility of implementation of the proposed work on a space platform. This review will be conducted by a team qualified to determine the feasibility of implementing the proposed projects using available flight and ground facilities. Please refer to the **Space Life Sciences Ground Facilities Information Package** available at:

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

The following criteria will be used in performing the flight feasibility review:

- **Functional Requirement:** Will the available flight hardware meet the functional requirements of the experiment?
- **Space Platform Resource Requirements:** To what extent will this experiment consume the launch vehicle capacity and flight platform resources (such as crew time and electrical power) that are projected to be available? Are sufficient resources available? Does this experiment require such a large amount of the available resources that it will preclude conduct of other experiments? Based on the required number of samples or subjects, can the experiment be carried out within a reasonable period of time?

- **Operational Impacts:** For experiments that utilize the crew as research subjects, could the implementation of these experiments, even if considered safe, lead to an impact on the performance of the crew subjects?

## E. Evaluation of Programmatic Relevance and Cost

*This review will be conducted only for the most highly rated proposals from the **merit** review.*

The evaluation of programmatic relevance and cost of each proposal will be conducted by NASA program scientists and managers as follows:

- **Programmatic Relevance:** In this context, programmatic relevance is the establishment of the relative priority of proposed projects for the AHST Program, based on current needs and considerations of programmatic balance. For example, a proposal with a high merit score for work that is redundant with work already being conducted may be passed over in favor of another proposal with a lower merit score in an area of higher programmatic need. Programmatic relevance evaluation will include the Critical Path Roadmap. The Critical Path Roadmap is available at:

**<http://criticalpath.jsc.nasa.gov/>**  
(follow links to appropriate discipline area).

- **Cost:** Evaluation of the proposed cost includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

## F. Development of Selection Recommendation

The most important element in the evaluation process is the merit review score, which carries the highest weight in final evaluation and selection. The other factors considered in the evaluation process (e.g., reviews for Feasibility of Implementation, Flight Feasibility, Programmatic Relevance, and Cost) are approximately equal in weight to each other; however, numerical scores are not assigned for these reviews. *Note also that these other reviews are conducted only for the most highly rated proposals from the **merit** review.*

The information resulting from these levels of review, as described above, will be used to prepare a **selection recommendation** developed by NASA program scientists and managers for each of the program elements described in this Announcement. This recommendation will be based on:

1. The scientific or technical merit review score from the peer review panel;
2. The results of the feasibility of implementation review;
3. The results of the flight feasibility review; and
4. The programmatic relevance and cost of each proposal.

This **selection recommendation** is the responsibility of the NASA program scientist(s). Selection for funding will be made by the selecting official identified in the Summary and Supplemental Information Section of this NRA.

At the end of the selection process, each proposing organization is notified of its selection or non-selection status. NASA provides debriefings to those investigators who request one. The selection letters will include a statement indicating the selected organization's business office will be contacted by a NASA Contracting or Grant Officer, who is the only official authorized to obligate the Government, and a reminder that any costs incurred by the investigator in anticipation of an award are at their own risk. Selection notification will be made by a letter signed by the selecting official.

The NASA Procurement Office will determine the type of award instrument, request further business data, negotiate the resultant action, and are the only personnel with the authority to obligate government funds.

The proposer should also understand that NASA may desire to select only a portion of the proposed investigation and/or that NASA may desire that individual proposer team with other proposers in a joint investigation, in which case the proposer will be given the opportunity to accept or decline such partial participation with other proposers prior to selection.

### **III. Eligibility**

All categories of institutions are eligible to submit proposals in response to this NRA, but only approved proposals from U.S. institutions will be selected for funding. Principal Investigators may collaborate with universities, Federal Government laboratories, the private sector, and state and local government laboratories. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal.

The applying entity must have in place a documented base of ongoing high quality research in science and technology or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this Announcement. Present or prior support by NASA of research or training in any institution or for any investigator is neither a prerequisite to submission of a proposal nor a competing factor in the selection process.

### **IV. Guidelines for International Participation**

**Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.** Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR

Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective investigator to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org/> and <http://www.bxa.doc.gov/>. Investigators are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered “Defense Articles” on the United States Munitions List and are subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

## **V. Program Reporting**

It is expected that results from funded research will be submitted to peer-reviewed journals as the work progresses. Only published papers that acknowledge NASA’s support and identify the grant or contract will be counted as resulting from the research project and used to evaluate its productivity.

**Annual Reporting.** The Office of Biological and Physical Research publishes a comprehensive annual document titled OBPR Program Tasks and Bibliography (Task Book) which includes descriptions of all peer-reviewed activities funded by the division during the previous fiscal year. Since its inception, the Task Book has served as an invaluable source of information for OBPR as well as the scientific and technical communities.

Investigators are required to provide NASA with this annual summary information. This information will be made available to the scientific community and will be used to assess the strength of the Division’s programs. It will also serve as the basis for determining the degree of progress of the project. The information provided for the Task Book will meet the requirements for annual reporting requirements and the task book. This report will be due 60 days prior to the anniversary date of the grant start date.

The information requested will include:

- an abstract
- a brief statement of progress during the fiscal year
- a brief statement of benefits of the research with respect to life on Earth and potential scientific, technological, economic or societal impact
- a list of scientific or technical publication and presentations for the fiscal year
- a listing of activities aimed at grades 6-12 (educational) or the general public (outreach)
- copies of each publication and presentation listed for the fiscal year
- notification of awards, honors, patents

Note that although this publication will be made available to the general scientific community, it is not a substitute for traditional scientific reporting in journals and elsewhere.

All articles submitted for publication must include the following statement: “This research was funded in whole or in part by a grant from the Office of Biological and Physical Research of the National Aeronautics and Space Administration.” Publications not including this acknowledgement will not be considered to be the product of NASA-funded research when NASA assesses the progress of the grant.

**Final Report** A final report is required that shall include all peer-reviewed publications.

## **VI. Support of Education and Public Outreach**

OBPR envisions that the selected proposals will be structured and operated in a manner that supports the nation’s educational initiatives and goals (including support of historically black colleges and universities and other minority universities), and in particular the need to promote scientific and technical education at all levels. OBPR envisions that the selected proposals will support the goals for public awareness and outreach to the general public (see Announcement Section). The selected principal investigators are invited to participate in OBPR-funded educational programs.

### **OBPR Policy for Education (Grades 6-12) and Public Outreach**

The proposal represents an opportunity for NASA to enhance and broaden the public’s understanding and appreciation of the value of OBPR research in the context of NASA’s mission. Therefore, all investigators are strongly encouraged to promote general scientific literacy and public understanding of OBPR research through formal and/or informal education opportunities. If appropriate, proposals should include a clear and concise description of the education and outreach activities proposed. Examples include such items as involvement of students in the research activities, technology transfer plans, public information programs that will inform the general public of the benefits being gained from the research, and/or plans for incorporation of scientific results obtained into educational curricula consistent with educational standards.

Where appropriate, the supported institution will be required to produce, in collaboration with NASA, a plan for communicating to the public the value and importance of their work.

Once NRA selections are made, the selected PIs will have an opportunity to request additional funding through an OBPR-sponsored pilot program to implement an education outreach program at the grades 6-12 level, at an amount not to exceed \$10,000 per year for the term of the grant. A request for proposal will accompany the selection notification letter. Proposals will be due within 60 days of selection notification and shall be limited to 4 pages. A review of these proposals by educational specialists will determine which proposals will be funded.

## VII. References

### A. General References

**Online Notice of Intent and Proposal Submission.** <http://proposals.hq.nasa.gov/proposal.cfm>

**Guidebook For Proposers Responding to a NASA Research Announcement (NRA).**

Although the Guidebook is currently being updated, it offers features like NRA FAQs that proposers may find useful. Available online at:

<http://www.hq.nasa.gov/office/procurement/nraguidebook>

**National Aeronautics and Space Administration Strategic Plan. (2000).** NASA, Washington, DC. <http://www.hq.nasa.gov/office/codez/plans.html>

**NASA's Biological and Physical Research Enterprise Strategic Plan. (2003).** NASA, Washington, DC. (coming soon) <http://www.hq.nasa.gov/office/codez/plans.html>

**NASA Bioastronautics Research Division Strategic Plan (2003).** NASA, Washington, DC. (coming soon) <http://www.hq.nasa.gov/office/codez/plans.html>

**NASA's Office of Biological and Physical Research.** NASA, Washington, DC. <http://spaceresearch.nasa.gov/>

**Critical Path Roadmap.** <http://criticalpath.jsc.nasa.gov/>

**Guidelines & Capabilities for Designing Human Missions (2002).** NASA Exploration Team Human Subsystem Working Group, National Aeronautics and Space Administration, Johnson Space Center, Houston, Texas.

[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)

**Space Life Sciences Ground Facilities Information Package.** This document is available online at the following address:

[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)

**OBPR Program Tasks and Bibliography (Task Book).** Available online at the following address: <http://research.hq.nasa.gov/taskbook.cfm>

**Space Life Sciences Data Archive (LSDA).** An online database containing descriptions and results of completed NASA-sponsored flight experiments. Phone: 281-483-7876; e-mail: [lsda@semail.jsc.nasa.gov](mailto:lsda@semail.jsc.nasa.gov); Web address: <http://lsda.jsc.nasa.gov/>

Life sciences research publications: <http://spaceline.usuhs.mil>, and <http://www.nlm.nih.gov>. Additional information may be obtained from the SPACELINE Project (phone: (301) 295-2482; e-mail: [spaceline@usuhs.mil](mailto:spaceline@usuhs.mil))

## **B. Programmatic References**

**NASA AHST Discipline Science/Technology Plans and Requirements Documents** produced by the program elements within the Advanced Human Support Technologies Program in the Life Sciences Division, NASA, Washington, DC:

**Advanced Human Support Technologies Program Plan (1999)**

**Advanced Environmental Monitoring and Control Project Plan (1999)**

**Advanced Environmental Monitoring and Control Technology Development Requirements (1998)**

**Advanced Environmental Monitoring and Control Strategic Plan (1996)**

**Advanced Environmental Monitoring and Control Program: Technical Assessment Matrix**

**Advanced Extravehicular Activity Exploration Requirements (JSC 2000):**  
<http://www.jsc.nasa.gov/xa/advanced.html>

**Advanced Life Support Project Plan (2002)**

**Advanced Life Support Requirements Document, JSC-38571B (2002)**

**Advanced Life Support Technology Assessment Matrix (1998)**

**Advanced Life Support Metric (2002)**

**Baseline Values and Assumptions Document (BVAD, 2002)**

**Advanced Life Support Systems Integration, Modeling and Analysis Reference Missions Document (JSC 2001)**

**Space Human Factors Engineering Project Plan**

**Space Human Factors Engineering Project Implementation Plan (2002-2003)**

**Space Human Factors Engineering Critical Research & Technology Definition (1996)**

Unless otherwise noted, the above documents are available online at

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

**NASA AHST Discipline Roadmaps** produced by the program elements within the Advanced Human Support Technologies Program in the Life Sciences Division, NASA, Washington, DC:

**Advanced Environmental Monitoring and Control Roadmap (1999)**

**Advanced Extravehicular Activity Systems Roadmaps (2000)**

<http://www.jsc.nasa.gov/xa/advanced.html>

**Advanced Life Support Roadmap (1998)**

**Space Human Factors Engineering Roadmap (1998)**

Unless otherwise noted, the above documents are available online at

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)**

## C. Other References

**Advanced Technology for Human Support in Space. (1997).** Report of the National Research Council (NRC) Committee on Advanced Technology for Human Support in Space, Aeronautics and Space Engineering Board (ASEB), National Academy Press, Washington DC (ISBN 0-309-05744-2; 1997) [http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-01/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-01/index.html)

**Assessment of Programs in Space Biology and Medicine. (1991).** National Academy of Sciences, National Research Council. Committee on Space Biology and Medicine, National Academy Press, Washington, DC.

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**CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER  
RESPONSIBILITY MATTERS**

***PRIMARY COVERED TRANSACTIONS***

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This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1269.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

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## **CERTIFICATION REGARDING LOBBYING**

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As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

- (a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;
- (b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, an or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

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**CERTIFICATION OF COMPLIANCE WITH THE NASA REGULATIONS PURSUANT  
TO  
NONDISCRIMINATION IN FEDERALLY ASSISTED PROGRAMS**

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The (Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant") hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S. 794), and the Age Discrimination Act of 1975 (42 U.S. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participating in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and the United States shall have the right to seek judicial enforcement of this assurance. His assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

## **INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS**

**(MAY 2002)**

**(a) General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate award instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

**(b) NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

**(1) Transmittal Letter or Prefatory Material.**

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

**(2) Restriction on Use and Disclosure of Proposal Information.** Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

## Notice

### Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) **Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

**(7) Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

**(8) Proposed Costs (U.S. Proposals Only).**

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

**(9) Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

**(10) Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

**(11) Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

**(d) Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

**(f) Joint Proposals.**

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award.

Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

**(i) Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

**(j) Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals.. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

**(k) Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation.

The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

**(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

**(m) Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.